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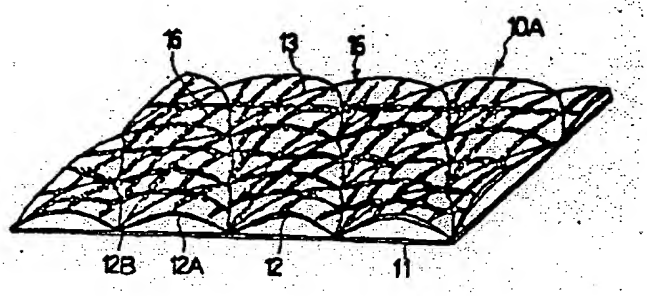
(54) [Title of the Invention] **Cleaning Article**

(57) [Abstract]

[Object] To provide a cleaning article that has a good capacity for trapping a broad range of dust, from fine dust to relatively larger types such as bread crumbs, where this capacity is effective regardless of the shape of the surface being cleaned, and that is resistant to napping, with good flexibility and hand, etc.

[Structure] The cleaning article of the present invention comprises a nonwoven base fabric formed of interlacing fibers united with, by being partially joined to, one or both sides of a foundation sheet, said base fabric having depressions and protrusions formed throughout the entire surface, where the parts that are joined are in the form of depressions, and the parts that are not joined are in the form of protrusions, wherein said

cleaning article is characterized in that the constituent fibers of the nonwoven base fabric joined to at least one side of the foundation sheet comprise heat fusing fibers.



[Claims]

[Claim 1] A cleaning article, comprising a nonwoven base fabric formed of interlacing fibers united with, by being partially joined to, one or both sides of a foundation sheet, said base fabric having depressions and protrusions formed throughout the entire surface, where the parts that are joined are in the form of depressions, and the parts that are not joined are in the form of protrusions, wherein said cleaning article is characterized in that the constituent fibers of the nonwoven base fabric joined to at least one side of the foundation sheet comprise heat fusing fibers.

[Claim 2] A cleaning article according to Claim 1, characterized in that the constituent fibers of the base fabric joined to at least one side of the foundation sheet comprise 1 to 99 wt% heat fusing fibers.

[Claim 3] A cleaning article according to Claim 1 or 2, characterized in that a chemical is supported in an amount of 0.1 to 500 wt% (based on the base fabric weight) on the base fabric.

[Claim 4] A cleaning article according to Claim 1, 2, or 3, characterized in that the foundation sheet is a heat shrinkable sheet that is heat shrunk by heat treatment so that the parts of the base fabric that are joined are in the form of depressions, and the parts that are not joined are in the form of protrusions.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application]

The present invention relates to a cleaning article for work areas and households, featuring the use a nonwoven fabric.

[0002]

[Prior Art]

Many cleaning articles based on fiber materials have been proposed in the past as cleaning utensils. Examples include scrubbing cloths comprising wet or dry cleaning cloths based on woven or nonwoven fabrics, chemical scrubbing cloths comprising flat woven or nonwoven fabrics impregnated with oils, and wet or dry types comprising

bundled yarn such as mops. Such cleaning articles are widely used, depending on their purpose, in offices, stores, buildings, plants, and the like.

[0003]

A drawback of cleaning articles comprising flat sheets such as chemical scrubbing cloths is that they do not conform to depressions on the surface being wiped as well as cleaning articles such as mops. In the technique proposed in Japanese Unexamined Patent Application (Kokai) 64-61546 for overcoming such a drawback, the nonwoven fabric serving as the cleaning article is provided with a three-dimensional shape, and after the nonwoven fabric has been formed, it is stitched with an elastic yarn to provide gathering. In the technique disclosed in Japanese Unexamined Patent Application (Kokai) 2-160962, the gathering process is managed with the use of shrinkable fiber to provide the cleaning sheet (cleaning article) with a three-dimensional shape, thereby providing better wiping performance than flat sheets. In the technique disclosed in Japanese Unexamined Patent Application (Kokai) 2-124122 and 2-99641, the surface of the cleaning sheet is piled to improve the wiping properties.

[0004]

[Problems Which the Invention Is Intended to Solve]

However, the cleaning articles in the form of sheets and mops described above suffer from the following drawbacks.

[0005]

Mop-like cleaning articles are generally effective for relatively sizable types of dust such as bread crumbs on surfaces. As described in Japanese Unexamined Patent Application (Kokai) 53-144156, for example, relatively sizable dust is readily trapped between strands of mop cord. However, since the dust is not entangled in the fibers forming the mop cord, the dust falls off when the mop is lifted up. Other problems are that a great deal of substrate is needed, cleaning is not managed as well as with sheets which are easier to use for cleaning, and walls or ceilings and the like are not as easy to clean as they are with a sheet article.

[0006]

The cleaning effects of sheets of nonwoven fabric and the like which have been given three-dimensional shapes by stitching or the like are relatively effective regardless of the shape of the surface that is being cleaned, but it is difficult to control the shape

sufficiently to handle a wide range of cleaning surfaces. The stitching reduces the freeness of constituent fibers, resulting in a lower capacity to trap frayed threads, lint, and the like.

[0007]

None of the aforementioned methods is capable of more effectively trapping dust because of the anisotropy produced in the direction in which the sheets are wiped. Another problem is the low capacity for retaining relatively sizable types of dust such as bread crumbs. That is, fine dirt such as sand is effectively wiped up, but relatively larger types of dust are not, and end up being left over.

[0008]

Additionally, cleaning sheets must be resistant to loss of nonwoven fibers (napping) and must thus have good napping resistance, either because of the friction between the surface of the cleaning sheet and the surface being cleaned, or because of cases where the cloth is snagged on protrusions or the like on the surface being cleaned.

[0009]

An object of the present invention is thus to provide a cleaning article that has a good capacity for trapping a broad range of dust, from fine dust to relatively larger types such as bread crumbs, where this capacity is effective regardless of the shape of the surface being cleaned, and that is resistant to napping, with good flexibility and hand, etc.

[0010]

[Means for Solving the Abovementioned Problems]

The present invention achieves the aforementioned objects by providing a cleaning article, comprising a nonwoven base fabric formed of interlacing fibers united with, by being partially joined to, one or both sides of a foundation sheet, said base fabric having depressions and protrusions formed throughout the entire surface, where the parts that are joined are in the form of depressions, and the parts that are not joined are in the form of protrusions, wherein said cleaning article is characterized in that the constituent fibers of the nonwoven base fabric joined to at least one side of the foundation sheet comprise heat fusing fibers.

[0011]

As used herein, a foundation sheet is a sheet with no shrinkable pores, and in particular excludes the reticulated sheet and porous sheet described in Japanese Patent Application 3-297489.

[0012]

[Action]

The wiping surface of the base fabric in the cleaning article of the present invention has a pattern comprising a plurality of flexible depressions and protrusions, which allow the article to readily conform to the shape of the surface being cleaned, with less likelihood of wiping traces. The base fabric comprising nonwoven fabric in the cleaning article of the present invention has higher bulk because it is partially joined to the foundation sheet and united therewith, resulting in a plurality of depressions and protrusions on the wiping surface of the base fabric. This ensures that the article is capable of trapping a wider range of types of dust, from fine dust to relatively larger types of dust such as bread crumbs or hair, which are entangled therein.

[0013]

The wiping side of the base fabric in the cleaning article of the present invention has a plurality of flexible depressions and protrusions, making it easier to conform to cleaning surfaces having such complicated shapes, with fewer wiping traces.

[0014]

The fiber aggregate constituent fibers of the cleaning article of the present invention comprise heat fusing fibers. The constituent fibers therefore will not fall off during cleaning, as these heat fusing fibers allow the reticulated sheet and fiber aggregate to be firmly joined with less adhesive surface area.

[0015]

[Examples]

Examples of the present invention are described in detail below with reference to figures. Figure 1 is a plan of a first example of the cleaning sheet in the present invention. Figure 2 is an enlarged partially cutaway oblique view of the cleaning sheet illustrated in Figure 1. Figure 3 is a schematic of the entire manufacturing apparatus preferably used in the production of the cleaning sheet of Example 1. Figure 4 is an enlarged partially cutaway oblique view of the cleaning sheet in a second example.

Figure 5 is a plan of a third example of the cleaning sheet. Figure 6 is an enlarged partially cutaway oblique view of the cleaning sheet illustrated in Figure 5. Figure 7 is an enlarged partially cutaway oblique view of a fourth example of the cleaning sheet. Figure 8 is a plan of a fifth example of the cleaning sheet. Figure 9 is a plan of a sixth example of the cleaning sheet.

[0016]

A cleaning sheet (cleaning article) 10A in the first example of the present invention is described first with reference to Figures 1 through 3.

[0017]

The cleaning sheet 10A in this example comprises a base fabric 12 of nonwoven fabric formed of interlacing fibers that is partially joined to, and united with, one side of a foundation sheet 11. The joined portions of the base fabric 12 form depressions 12B, and the portions that are not joined form protrusions 12A. The cleaning sheet 10A has a pattern of depressions and protrusions over the entire surface. The constituent fibers of the base fabric 12 comprise heat fusing fibers. Laminated to the exterior of the base fabric 12 of the cleaning sheet 10A is a nonwoven fabric net 16 comprising integrated interlacing fibers with a greater distance between fibers than the base fabric 12. The nonwoven fabric net 16 may be dispensed with in the cleaning sheet (cleaning article) of the present invention.

[0018]

The foundation sheet 11 is heat shrinkable. Examples include films or sheets of polyethylene, polypropylene, polybutene [sic] or similar polyolefin resins, polyethylene terephthalate, polybutylene terephthalate or similar polyester resins, polyvinyl chloride or similar vinyl resins, polyvinylidene chloride or similar vinylidene resins, modified synthetic resins thereof, mixtures of two or more, composite materials featuring the use of such synthetic resins, or the like, which should be uniaxially or biaxially shrunk, with sufficient shrinking force to form the aforementioned protrusions 12A and depressions 12B on the base fabric 12. When such heat shrinkable films or sheets are used to produce the cleaning sheet 10A, the heat treatment of these heat shrinkable films or sheets allows a plurality of depressions and protrusions to be formed on the surface of the base fabric 12.

[0019]

The thickness of the foundation sheet 11 is determined in consideration of the shape of the depressions and protrusions formed by the shrinking force and shrinking rate, the degree to which the depressions and protrusions are to be formed, and the fabrication of the partially joined areas with the base fabric 12.

[0020]

The base fabric 12 is formed of interlacing fibers in such a way that fine dust adhering to surfaces can be trapped between the constituent fibers. Rigid and relatively long types of debris such as hair can also be trapped by becoming interlaced with the constituent fibers of the nonwoven fabric.

[0021]

The heat fusing fibers included in the constituent fibers of the base fabric 12 should contain a component with a melting point at least 10°C lower than the melting point of the other constituent fibers of the base fabric 12. Examples include core-sheath composite fibers with a high melting point polymer core and a low melting point polymer sheath, or side-by-side types of composite fibers in which high melting point polymers are joined with low melting point polymers. Single-component low melting point polymer fibers may also be used. Examples of combinations of high melting point polymers and low melting point polymers forming such composite fibers include polypropylene/polyethylene, polyethylene terephthalate/polyethylene, and high melting point polyester/low melting point polyester. Examples of low melting point polymers forming the low melting point polymer fibers include polyethylene, ethylene copolymers, vinyl chloride copolymers, and low melting point polyesters.

[0022]

When a heat shrinkable sheet is used as the foundation sheet 11, the heat fusing fibers should have a melting point lower than the shrinking temperature of the heat shrinkable sheet. The use of such heat fusing fibers allows the constituent fibers of the base fabric 12 to be fused together and allows the base fabric 12 to be joined with the heat shrinkable sheet at the same time that the heat shrinkable sheet is heated during the manufacture of the cleaning sheet 10A.

[0023]

The base fabric 12 preferably has a heat fusing fiber content of 1 to 99 wt%, more preferably 3 to 70 wt%, and even more preferably 5 to 50 wt%. A heat fusing fiber content of less then 1 wt% fails to adequately prevent the fibers from falling off, while more than 99 wt% can result in a cleaning sheet with poor flexibility, a lower degree of freeness, and a poor hand.

[0024]

Examples of constituent fibers for the base fabric 12 other than heat fusing fibers include polyester fibers, polyamide fibers, polyolefin fibers, acrylic fibers and similar synthetic fibers, composite fibers using such fiber resins, semi-synthetic fibers such as acetate fibers, regenerated fibers such as rayon and capra, as well as natural fibers such as cotton, hemp, or wool, and blends thereof.

[0025]

The basis weight of the base fabric 12 can be established based on a comprehensive consideration of the degree of constituent fiber interlacing, strength, processability, cost, and the like, but is preferably within the range of from 30 to 150 g/m^2. Less than 30 g/m^2 results in unsatisfactory interlacing and strength, whereas more than 150 g/m^2 can lead to higher costs.

[0026]

The fineness of the constituent fibers of the base fabric 12 should range from 0.5 to 6.0 denier. Less than 0.5 denier results in fiber with a poor capacity for forming a web, whereas more than 6.0 denier tends to interfere with fiber interlacing and results in a poor capacity for trapping fine dust.

[0027]

The base fabric 12 is encompassed by a lattice-like network of junctions 13, where the parts that are not joined with foundation sheet 11 form protrusions 12A. A pattern of depressions and protrusions are formed on the cleaning surface of the cleaning sheet as a whole. The plurality of protrusions 12A and depressions 12B therebetween form a cleaning surface with a high level of cushioning, so that the cleaning surface is effective regardless of the shape of the surface being cleaned.

[0028]

The size of the protrusions 12A and depressions 12B formed on the cleaning surface is preferably 1 to 30 mm from the center of the foundation sheet 11 to the center of the base sheet 12. Less than 1 mm results in poor cushioning and conformability with the surface being cleaned, whereas more than 30 mm results the need for more base cloth and this higher costs.

[0029]

Slit openings 12C as indicated in the third example below may be formed in the protrusions 12A.

[0030]

As shown in Figure 2, a nonwoven fabric net 16 with a large distance between fibers is disposed on the exterior of the base fabric 12 (the side opposite the foundation sheet 11). The nonwoven fabric net 16 is partially joined at the joined portions 13 to the base fabric 12. That is, the parts where the foundation sheet 11 and the nonwoven fabric net 16 are not joined form protrusions 12A, while the parts that are joined 13 form depressions 12B. A cleaning surface with a high level of cushioning is thus formed by the base fabric 12. Placing the nonwoven fabric net 16 in this manner allows relatively sizable dust such as bread crumbs to be more effectively trapped.

[0031]

The parts 13 where the foundation sheet 11 and the base fabric 12 are partially joined form a continuous dot pattern, resulting in a lattice-like formation, as shown in Figure 1. The parts 13 where the foundation sheet 11 is joined with the base fabric 12 and nonwoven fabric net 16 should allow the protrusions 12A to be formed by just the base fabric 12 or by the base fabric 12 and the nonwoven fabric net 16. To avoid any loss of sheet flexibility, the mode of joining is more advantageously managed with points such as dots rather than by linear joining.

[0032]

Joined parts 13 with smaller dots are less likely to result in a loss of flexibility. The surface area and number of dots in the joined areas should therefore be determined within a range allowing substantially firm joining of the foundation sheet 11, base fabric 12, and nonwoven fabric net 16.

[0033]

The nonwoven fabric net 16 must have a greater distance between fibers than the nonwoven fabric used in the base fabric 12. The type and denier of the constituent fibers are the same as for the base fabric 12. The fibers can be interlaced by bringing a flow of water into contact with the web. The degree of interlacing at this time is generally proportional to the dust trapping capacity. The strength of the nonwoven fiber is affected by the type, properties, and basis weight of the constituent fibers.

[0034]

The distance (a) between fibers defined in Equation (1) below significantly influences the strength of the nonwoven fabric.

[0035]

[Equation 1]

$$a = (DV/9000W)^{1/2} \qquad (1)$$

D: denier (d)

V: volume (m^3) of nonwoven fabric

W: weight (g) of nonwoven fabric

Here, the volume V of the nonwoven fabric can be determined from the load-free thickness and area.

[0036]

Too great a distance between fibers will result in lower strength, whereas too small a distance between fibers will reduce the fiber freeness and compromise the ability to entangle relatively large solids such as bread crumbs.

[0037]

Specifically, the distance between the fibers of the base fabric 12 are no more than 80 μm, while the distance between the fibers of the nonwoven fabric net 16 is at least 50 μm. The distance between the fibers of the base fabric 12 and the fibers of the nonwoven fabric net 16 must comply with the relation represented in Equation (2) below.

[0038]

[Equation 2]

distance between fibers of base fabric 12 < distance between fibers of nonwoven fabric net 16 (2)

[0039]

The method for providing the openings of the nonwoven fabric net 16 is not limited. Locations in which fibers are present and locations with holes may be regularly distributed, and the constituent fibers of the nonwoven fabric may be randomly distributed. Openings that are too large, however, will make it more difficult to entangle relatively large types of dust such as bread crumbs, while openings that are too small or a basis weight that is too great can inhibit the wiping effects of the base fabric 12. Suitable levels must therefore be established. The design of the nonwoven fabric net 16 should be such that a web of the constituent fibers of the nonwoven fabric net 16 is laminated in a pattern such as stripes or a lattice on the surface of the base fabric 12, and the nonwoven fabric net 16 is then formed on the surface of the base fabric 12 by a method such as water jet interlacing (water needling).

[0040]

Because of the relatively great distance between the fibers of nonwoven fabric nets 16, the nonwoven fabric tends to have lower strength, with the possibility of producing lint (fuzz). To therefore improve the strength without compromising the surface properties of the nonwoven fabric net 16, virtually no heat fusing fibers such as binder fibers should be present on the cleaning surface, and the cleaning surface should be suitably joined by heat fusing fibers to the opposite surface, that is, the surface on the base fabric 12 side.

[0041]

Specifically, the nonwoven fabric net 16 should be interlaced and unified by water needling or the like after a fiber web layer A which contains heat fusing fibers is laminated with a fiber web layer B which contains virtually no heat fusing fibers, that is, which consists of fibers having suitable cleaning properties. At such times, in common methods such as water needling, the interlacing should be selected by adjusting the water needling water pressure or the like, so as to reduce any random intermingling between the web layer A and web layer B.

[0042]

Some of the constituent fibers of the fiber web layer B are then joined by means of the heat fusing fibers contained in the fiber web layer A as a result of heat treatment.

[0043]

Openings may be formed by partially punching the nonwoven fabric or the like. When the nonwoven fabric is formed by water needling, it may be formed by using a coarse mesh for the support net when the web fibers are interlaced.

[0044]

The dimensions of the cleaning sheet 10A in the present invention should be determined in view of the surface that is to be cleaned or the shape and surface area being cleaned, etc., but the length of one side perpendicular to the wiping direction when the invention is used should be 5 to 150 cm, preferably 10 to 140 cm in the case of household use, and 10 to 150 cm for industrial use.

[0045]

As shown in Figure 1, the cleaning sheet 10A has free end regions 14 in the peripheral extensions, and a main body 15. The free end regions 14 are 1/30 to 1/2 the dimensions of the main body 15, on the outside from the border with the main body 15. Less than 1/30 or more than 1/2 results in a lower dust trapping capacity and poor conformability to locations such as the angles of which the surface to be cleaned is formed.

[0046]

A chemical befitting a required function can be supported in an amount of 0.1 to 500 wt% (based on the base fabric weight) on the base fabric in the cleaning article of the present invention. Such chemicals include those based on oil components for substantially dry types of cleaning, and detergents or the like for substantially wet types of cleaning.

[0047]

Examples of oil components should include at least one of mineral oils, synthetic oils, silicone oils, or surfactants. Examples of mineral oils include paraffin hydrocarbons, naphthene hydrocarbons, and aromatic hydrocarbons.

[0048]

Examples of synthetic oils include alkylbenzene oils, polyolefin oils, and polyglycol oils. Examples of silicone oils include chain dimethylpolysiloxanes, cyclic dimethylpolysiloxanes, methylhydridopolysiloxanes, and various modified silicones.

[0049]

Examples of surfactants include cationic surfactants, such as mono-long-chain alkyl trimethylammonium salts with C_{10} to C_{22} alkyl groups or alkenyl groups, di-long-chain alkyl dimethylammonium salts, and mono-long-chain alkyl dimethylbenzylammonium salts; nonionic surfactants such as polyoxyethylene (6 to 35 mol) long-chain alkyl or alkenyl (primary or secondary C_8 to C_{22}) ethers, polyoxyethylene (6 to 35 mol) alkyl (C_8 to C_{18}) phenyl ethers and similar polyethylene glycol ethers, polyoxyethylene polyoxypropylene block copolymers, glyceryl fatty acid esters, sorbitan fatty acid esters, or alkyl glycoside or similar polyhydric alcohols, etc. Surfactants should contain no more than 5 wt% water for the sake of more effective washing.

[0050]

The viscosity (at 25°C) of the oil component is preferably 5 to 1000 cps, and even more preferably 5 to 200 cps. Less than 5 cps results in poor dust absorption, whereas more than 1000 cps results in less uniform spreading of the oil on the fibers and in a greater friction coefficient with the cleaning surface, causing damage to the cleaning surface of the article. The surface tension (at 25°C) should be 15 to 45 dyn/cm, and preferably 20 to 35 dyn/cm. Less than 15 dyn/cm results in poor dust absorption, while more than 45 dyn/cm results in less uniform spread on the fibers forming the nonwoven fabric.

[0051]

The oil component is supported in an amount of 0.1 to 80%, preferably 0.5 to 40%, and even more preferably 1 to 20%, relative to the weight of the base fabric. Such a proportion affords a better dust absorption capacity and dust retention capacity. Supporting an oil component in an amount less than 0.1% sill not improve the dust absorption and retention, whereas more than 80% will result in a much greasier feel on the hands. The formation of the pattern of depressions and protrusions on the surface of the fiber aggregate in the cleaning article of the present invention prevents the oil component supported on the base fabric from adhering to the hands when touched and results in less greasiness.

[0052]

As noted above, the oil component preferably include at least one of mineral oils, synthetic oils, silicone oils, or surfactants, but the proportion and type, as well as the viscosity, surface tension, and the like are determined according to the type of constituent fibers of the nonwoven fabric and the purpose of cleaning. The oil component can also include antibacterials, mildewcides, antibiotics, and the like as needed.

[0053]

A detergent should be an aqueous solution including at least one of surfactants, solvents, or alkali agents.

[0054]

Examples of surfactants include nonionic surfactants, cationic surfactants, anionic surfactants, and amphoteric surfactants. Examples of anionic surfactants include common sulfonate anionic surfactants and sulfate anionic surfactants. Examples of sulfonate anionic surfactants include linear or branched alkyl (C_8 to C_{22}) benzenesulfonates, long-chain alkyl (C_8 to C_{22}) sulfonates, and long-chain olefin (C_8 to C_{22}) sulfonates. Examples of sulfate anionic surfactants include long-chain monoalkyl (C_8 to C_{22}) sulfate ester salts, polyoxyethylene (1 to 6 mol) long-chain alkyl (C_8 to C_{22}) ether sulfate ester salts, and polyoxyethylene (1 to 6 mol) alkyl (C_8 to C_{22}) phenyl ether sulfate ester salts. Examples of counterions for such anionic surfactants include cations such as sodium, potassium or other alkali metal ions, and monoethanolamine, diethanolamine, and triethanolamine or other alkanolamine ions. For the sake of stronger resistance to hydrolysis, sulfonate surfactants are preferred as anionic surfactants. For the sake of detergency, long-chain or branched alkylbenzenesulfonates are preferred. Examples of amphoteric surfactants include C_8 to C_{22} alkyl group-containing carbobetaines, sulfobetaines, and hydroxysulfobetaines. Examples of nonionic surfactants and cationic surfactants include the same ones given as examples for the oil component. Examples of solvents include alcohols such as ethanol and isopropanol, glycols such as ethylene glycol and propylene glycol, and glycol ethers such as ethylene glycol monoethyl ether and propylene glycol monomethyl ether. Examples of alkali agents include alkanolamines such as monoethanolamine. The aforementioned detergent can include components such as antibacterials, deodorizers, and fragrances as needed. The detergent is supported in an amount of 50 to 500%, and preferably 100 to 300%, relative to the weight of the base fabric. Supporting the detergent in this proportion can improve the effects in washing dirt and soil on the hands, etc. Supporting the detergent in

an amount lower than 50% results in a smaller surface area capable of cleaning, whereas an amount greater than 500% is too difficult to retain during cleaning, and will fall off.

[0055]

The cleaning sheet of the present invention (cleaning article) may be manufactured in the following manner, for example.

[0056]

As shown in Figure 3, A base fabric 12 is partially joined to, and thus united with, one or both sides of a heat shrinkable foundation sheet 11, the foundation sheet 11 is then heated and shrunk, so that depressions 12B are formed in the parts that are joined, and protrusions 12A are formed in the parts that are not joined, a cleaning sheet with depressions and protrusions throughout the entire surface is formed, and when a chemical is deposited on the base fabric 12, the cleaning sheet is impregnated with the chemical before or after the cleaning sheet is heated.

[0057]

Initially, the rolled up base fabric 12 is unrolled by a feed roll 21. Slit openings 12C (described below) may be formed if needed by a device 23 for forming openings in the unrolled base fabric 12. The device 23 for forming openings comprises a rotary die cutter 23A and an anvil roll 23B. When the base fabric 12 passes by the rotary die cutter [sic] 23B, a plurality of slit openings 12C are formed by the rotary die cutter 23A. However, the device 23 for forming openings is not necessary when no slit openings 12C are to be formed. The device 23 for forming openings may be employed in processes subsequent to the placement of the nonwoven fabric net 16 described below to form the slit openings 12C.

[0058]

As the base fabric 12 is conveyed on-line, the foundation sheet 11 and nonwoven fabric net 16 are wound onto rolls and positioned, so that the foundation sheet 11 and the nonwoven fabric net 16 which have been fed from their respective rolls are laminated to the base fabric 12 by guide rolls 24A and 24B. Here, the foundation sheet 11 and nonwoven fabric net 16 are disposed so as to sandwich the base fabric 12, and they are joined thereto by a dot pattern which forms the lattice shape as a whole by means of a joining device 25.

[0059]

The joining device 25 comprises a horn 25A emitting sonic waves and an embossing roll 25B having a die formed in the prescribed dot pattern. As the laminated foundation sheet 11, base fabric 12, and nonwoven fabric net 16 pass by, the sheets 11, 12, and 16 are joined, a shown in Figure 1, forming the lattice-shaped joined parts 13.

[0060]

The method for joining with the aforementioned joining device 25 may be a method in which an adhesive is applied in a pattern on at least one of either the foundations sheet 11 or base fabric 12, or a method of heated pressure. When an adhesive is used, an adhesive with sufficient adhesive force must be used so as to avoid peeling when the foundation sheet 11 is heat shrunk. At the same time, the adhesive must not seep into the areas which are not joined with the base fabric 12, so as to ensure consistent processing.

[0061]

In methods of heated pressure, materials that allow the foundation sheet 11 and base fabric 12 to be joined together through fusing or with an anchor effect should be selected. Specific examples include heat embossing and ultrasonic techniques, which may be selected as desired depending on the processing rate and material. In addition to ultrasonic methods, a heating method may be used. Such methods are selected as desired depending on the selection of material and the processing rate.

[0062]

After the base fabric 12 and nonwoven fabric net 16 have been united with the foundation sheet 11, the base fabric 12 and nonwoven fabric net 16 are conveyed to the chemical application step, where the chemical is applied to the base fabric 12 and nonwoven fabric net 16.

[0063]

A chemical applicator 26 comprises a gravure roll 26A for carrying a suitable amount of the chemical to the united sheets, a back up roll 26B for pushing the united sheets against the gravure roll 26A, and a liquid pan 26C for catching the chemical.

[0064]

In Figure 3, the roll cutter is used as the applicator 26, but a spraying method may also be used. Such a method is selected as desired depending on the processing rate, selection of material, type of chemical, and the like.

[0065]

The application of the chemical by a spraying method is effective when the chemical is provided after the heat shrinking. The chemical-coated sheets are guided by a nip roll 27 to a heat treatment device 28.

[0066]

The heating device 28 heat shrinks the foundation sheet 11, and is set to a temperature causing the foundation sheet 11 to undergo heat shrinkage. As the joined foundation sheet 11 and base sheet 12 pass through the heating device 28, only the foundation sheet 11 is shrunk, while the base fabric 12 and nonwoven fabric net 16 do not shrink, so that the pattern of depressions and projections is formed in conformance with the embossing pattern on the base fabric 12 and nonwoven fabric net 16. The device should be set to the temperature and time producing the target area shrinkage rate. The rate ratio between the nip roll 27 upstream of the heating device 28 and the nip roll 29 down stream should be set to the target area shrinkage rate.

[0067]

The area shrinkage rate is represented by the following Equation (3).

[0068]

[Equation 3]

$$\text{area shrinkage rate } (\%) = 100 - A \times B \times 100 \qquad (3)$$

A: (longitudinal length on one side after heat shrinkage)/(longitudinal length on one side before heat shrinkage)

B: (lateral length on one side after heat shrinkage)/(lateral length on one side before heat shrinkage)

[0069]

After the sheets have passes through the heating device 28, they are guided by the nip roll 29 and taken up by a take up device 30.

[0070]

Other examples of the present invention are described below with reference to Figures 4 through 9. Figure 4 depicts a cleaning sheet in a second example of the present invention. In the second example, the base fabric 12 is disposed on both sides of the foundation sheet 11, and nonwoven fabric nets 16 are placed on the exterior of both base fabrics 12. That is, the base fabric 12 and nonwoven fabric net 16 in the first example are placed on both sides of the foundation sheet 11.

[0071]

In the case of cleaning articles in which the base fabric has been placed on both sides of the foundation sheet as in the second example, the base fabrics on either side of the sheet may be the same or different. It is thus possible, for example, to use base fabrics with differing heat fusing fiber contents on either side or with different types of constituent fibers on either side, so as to produce an article which can be used for different purposes on either side or to produce an article with a different hand on either side.

[0072]

Figures 5 and 6 depict a cleaning sheet 10C in a third example of the present invention. In the third example, only a base fabric 12 is placed on one side of the foundation sheet 11, and no nonwoven fabric net 16 is provided. Slit openings 12C are formed in the protrusions 12A. Relatively large types of dust that are difficult to trap by the constituent fibers alone are taken up through the slit openings 12C into the protrusions 12A.

[0073]

In the case of the third example, the area of the openings of the slit openings 12C should range from 1 to 100 mm^2. An area lower than 1 mm^2 limits the dust that can be taken up into the slit openings 12C and makes it more difficult to take up dust such as bread crumbs. An area greater than 100 mm^2 tends to let the trapped dust fall back out.

[0074]

The slit openings 12C should occupy about 5 to 60% of the cleaning surface. Less than 5% makes it more difficult to trap dust, whereas more than 60% results in a low capacity for trapping fine dust on the base fabric.

[0075]

The application of a low-tack adhesive on the inner surface of at least one of either the foundation sheet 11 and nonwoven fabric 12 where they are not joined can prevent trapped dust from falling out through the slit openings 12C. The slit openings 12C are formed by cutting partial slits after the nonwoven fabric 12 has been formed into a sheet. They may also be punched, for example. When the nonwoven fabric is formed by water needling, the slit openings 12C may be formed by using a coarse mesh for the support net during the interlacing of the web fibers.

[0076]

Figure 7 depicts a cleaning sheet 10D in a fourth example of the present invention. In the fourth example, the base fabric 12 is disposed on either side of the foundation sheet 11, and the protrusions 12A are randomly formed on both sides of the foundation sheet 11.

[0077]

Figure 8 depicts a cleaning sheet 10E in a fourth [sic] example of the present invention. In the fourth [sic] example, the peripheral extension of the main body 15 has free ends 14 which are areas that are not joined to the foundation sheet 11. That is, a base fabric 12 formed by interlacing fibers is partially joined to one or both sides of a foundation sheet 11 having a smaller area than the base fabric 12. The main body 15 is formed in areas corresponding to the foundation sheet 11, and the free ends 14 are formed on either end (two sides).

[0078]

Figure 9 depicts a cleaning sheet 10F in a fifth [sic] example of the present invention. In the fifth [sic] example, unlike the aforementioned fourth [sic] example in which free ends 14 are formed on either end (two sides) of the main body 15, the free ends 14 are formed on around the entire periphery (four sides).

[0079]

Specific examples of products of the present invention are described below in comparisons with comparative products.

Example 1: base fabric placed on only one side of the foundations sheet, as shown in Figure 2, with a nonwoven fabric net provided

The base fabric was a blend of polyester fibers (1.5 d, 51 mm) and polypropylene/polyethylene core-sheath fiber (3 d, 51 mm) in a polyester fiber/core-sheath fiber weight ratio of 7/3. This was used to form a fiber web with a basis weight of 10 g/m^2 by a common carding method. The fiber web was lapped in 6 layers (60 g/m^2), and was interlaced by water needling. The water jet interlacing was managed at a water pressure of 40 kg/cm^2 and a rate of 5 m/min, with nozzle heads having a nozzle pitch of 1.6 mm provided in 4 blocks in the machine direction.

[0080]

The nonwoven fabric net was formed by producing a fiber web with a basis weight of 10 g/m^2 from polyester fibers (by Teijin) (3 d, 76 mm) by common carding, forming another fiber web with a basis weight of 10 g/m^2 from polypropylene/polyethylene core-sheath fiber (by Chisso) (3 d, 51 mm) by common carding, then laminating the webs and interlacing the resulting web by water needling. The product was then punched to form a circle with a 15 mm diameter in a center distance of 20 mm. The water jet interlacing was managed under the same conditions as above except that the water pressure was 20 kg/cm^2.

[0081]

A 15 μm thick biaxially oriented polypropylene shrink film (by Gunze) with the same area as the base fabric was used as the foundation sheet. The base fabric and nonwoven fabric net were laminated, and were then joined using an ultrasonic embossing roll. The joining pattern consisted of 2 mm diameter circles arrayed in lines at intervals of 84 mm, with the linear pattern forming continuous diamonds with diagonal lines of 39.27 mm and 24.17 mm. The product was then heat treated for 30 seconds at 110°C, giving a cleaning sheet with an approximately 20% area shrinkage rate.

[0082]

A product 1 was obtained by providing an oil component (viscosity of 125 cps, surface tension of 30 dyn/cm) comprising 95% liquid paraffin and 5% nonionic surfactant (polyoxyethylene (3.3 average number of mol added) alkyl (C_{12} to C_{13}) ether) by a spraying process on the cleaning sheet in a proportion of 5% relative to fiber weight (weight of base fabric).

[0083] Example 2: base fabric on both sides of foundation sheet, as shown in Figure 4, with nonwoven fabric net

Product 2 was obtained in the same manner as Product 1 except that the starting material for the upper layer fiber web was a blend of a polyester fiber (3 d, 51 mm) and a polypropylene/polyethylene core-sheath fiber (3 d, 51 mm) in a polyester fiber/core-sheath fiber weight ratio of 3/7, and the starting material for the lower layer fiber web was a blend of polyester fiber and core-sheath fiber in a weight ratio of 7/3 (area shrinkage of 20%).

[0084] Comparative Example 1: base fabric containing no heat fusing fibers

Comparative Product 1 was obtained in the same manner as Product 1, except that the starting material for the upper and lower layers of fiber web comprised polyester fiber (1.5 d, 51 mm).

[0085] Comparative Product 2: base fabric comprising only heat fusing fibers

Comparative Product 2 was obtained in the same manner as Product 1, except that the starting material for the upper and lower layers of fiber web comprised polypropylene/polyethylene core-sheath fiber (3 d, 51 mm).

[0086]

The Examples and Comparative Examples prepared above were assessed in the following manner.

1. Hair trapping capacity

Ten strands of approximately 10 cm long hair were scattered without being placed atop each other. The above products and comparative products were laminated to 7 × 11 cm sponges, and were rubbed back and forth three times over the hairs. The capacity to trap the hair without releasing it was organoleptically assessed.

[0087]

The following criteria were used.

*: picked up 8 to 10 hairs without dropping them
O: picked up 8 to 10 hours, dropping some
Δ: picked up 5 to 7 hairs, tending to drop them
×: picked up less than 5 hairs

[0088] 2. Surface napping resistance

15 × 15 cm products and comparative products were tested with a 500 g load on disk-shaped sponges 7 cm in diameter and 2 cm thick (by Oe, Kincho Cleaner No. 5005) by rubbing them in circles 4 cm in diameter from the center of the sponges at a rate of one rotation per second. One cycle was a single clockwise rotation and a single counterclockwise rotation. After 10 cycles, the number of fibers adhering to the sponge was counted.

[0089]

The following criteria were used.

*: no fibers
O: virtually no fibers
Δ: fibers adhering to periphery of disk

[0090]

The results are summarized in Table 1.

[0091]

[Table 1]

		Hair trapping capacity	Surface napping resistance
Example of invention	1	O	*
	2	O/* upper layer/lower layer	*/O upper layer/lower layer
Comparative example	1	O	Δ
	2	×	*

[0092]

Table 1 shows that the bulky sheets of Products 1 and 2 of the invention had good hair trapping capacities and resistance to napping, whereas Comparative Products 1 and 2 were inadequate in terms of either hair trapping capacity or napping resistance. Comparative Product 2 in particular had a poor hair trapping capacity, making it unsuitable as a cleaning article.

[0093]

The present invention is not limited to the examples described above. Various modifications are possible within the scope of the present invention. For example, the method for applying the chemical on the cleaning sheet may involve immersing the sheet in the chemical.

[0094]

The cleaning sheet can be used to clean while held in the hands, or it may be affixed to a handled utensil for use as a cleaning article. Without particularly limiting the shape, a utensil with a handle may include mops, handy wipes, and dusters. Cleaning parts that are flat, viewed macroscopically, are particularly preferred.

[0095]

[Effects of the Invention]

The cleaning article of the present invention has a good capacity for trapping a broad range of dust, from fine dust to relatively larger types such as bread crumbs, where this capacity is effective regardless of the shape of the surface being cleaned, and that is resistant to napping, with good flexibility and hand, etc.

[Brief Description of the Figures]

[Figure 1] Figure 1 is a plan of a first example of the cleaning sheet in the present invention.

[Figure 2] Figure 2 is an enlarged partially cutaway oblique view of the cleaning sheet illustrated in Figure 1.

[Figure 3] Figure 3 is a schematic of the entire manufacturing apparatus preferably used in the production of the cleaning sheet of Example 1.

[Figure 4] Figure 4 is an enlarged partially cutaway oblique view of the cleaning sheet in a second example.

[Figure 5] Figure 5 is a plan of a third example of the cleaning sheet.

[Figure 6] Figure 6 is an enlarged partially cutaway oblique view of the cleaning sheet illustrated in Figure 5.

[Figure 7] Figure 7 is an enlarged partially cutaway oblique view of a fourth example of the cleaning sheet.

[Figure 8] Figure 8 is a plan of a fifth example of the cleaning sheet.

[Figure 9] Figure 9 is a plan of a sixth example of the cleaning sheet.

Figure 1

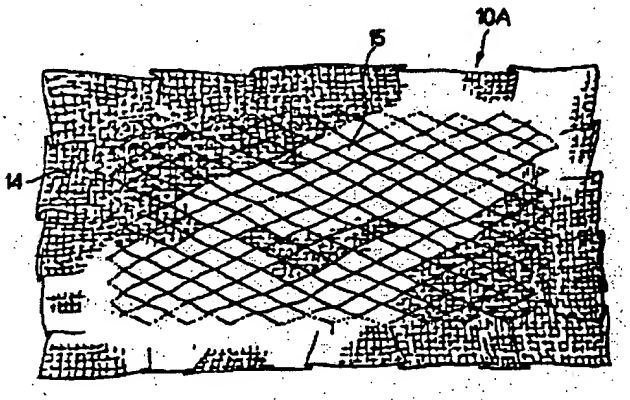


Figure 2

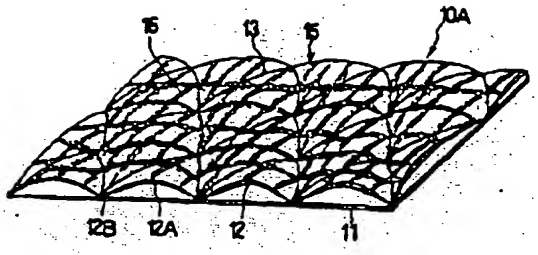


Figure 3

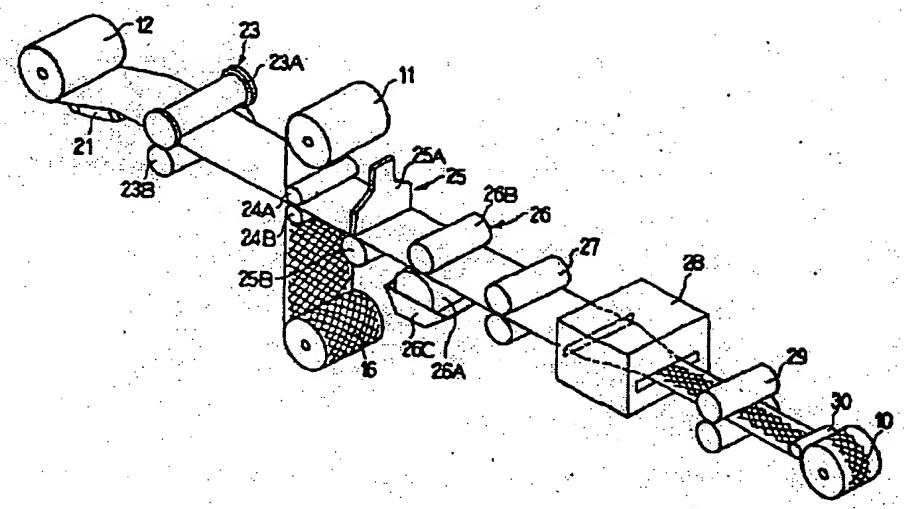


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Figure 4

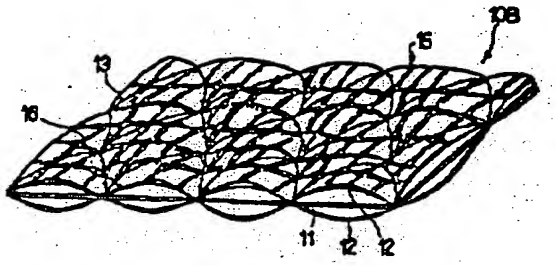

Figure 5

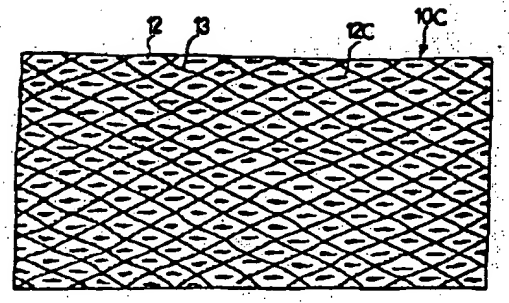

Figure 6

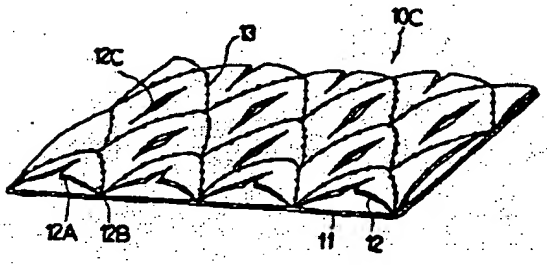

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Figure 7

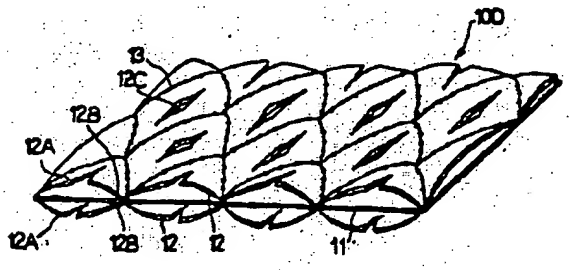

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Figure 8

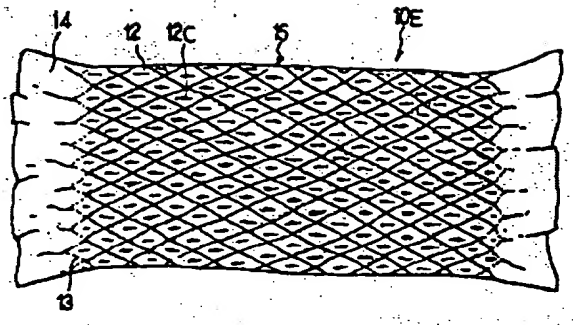

Figure 9